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Robber Flies (Diptera: Asilidae) of Iranian Rice Fields and Surrounding Grasslands

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A b s t r a c t : Rice fields are an interesting agroecosystem that supports a diverse insect fauna. Robber flies (Insecta: Diptera: Asilidae) were studied in rice fields and the surrounding grasslands of Iran from 2002 to 2006. Twenty six species representing 19 genera and 7 subfamilies of asilids were collected resting on rice seedlings and 23 species of weedy plants surrounding fields. Of these, 9 species are new records for Iranian fauna.

K e y w o r d s : Asilidae, Rice fields, Weeds, Iran.

Introduction

Rice is the primary food for half the people in the world, providing more calories than any other single food. Arthropods are the main terrestrial invertebrates of rice fields. Most are insects and spiders that largely inhabit the vegetation and soil surface. These arthropod communities can be further divided into rice pests, their natural enemies (predators and parasitoids) and neutral forms. In rice fields the composition of the terrestrial arthropod communities are known to change during the growth of the rice crop (BAMBARADENIYA & AMERASINGHE 2003). Several pests including, stem borers (Lepidoptera: Pyralidae), *Naranga aenescens* MOORE, *Pseudaletia unipunctata* HAWORTH (Lepidoptera: Noctuidae), plant hoppers (Homoptera: Cicadellidae, Delphacidae), and grasshoppers (Orthoptera: Acrididae), damage and reduce the yields of this crop (DATTA & KHUSH 2002). Although pesticides can control many of the rice pests, because of environmental risks and the killing of beneficial species (natural enemies and pollinators), their use is not efficient and safe (KHAN et al. 1991).

Several natural enemies of pests, especially predators, can potentially decrease the population densities of rice pests (MOHYUDDIN 1990; BONHOFF et al. 1997). The most important predators collected in rice fields are in the insect orders Coleoptera, Hemiptera, Hymenoptera, Diptera (especially Asilidae and Syrphidae), Mantodea, Odonata, and Orthoptera. Numerous spider species are also present (POLASZEK 1998; HEINRICHS & BARRION 2004).

Robber flies comprise an abundant and diverse family of Diptera known for their predatory behavior. The family Asilidae belongs to the superfamily Asiloidea within the suborder Brachycera and contains approximately 6.750 described species distributed

throughout the world (GELLER-GRIMM 2002). Certain groups are characteristic of particular regions (HULL 1962). For instance, the subfamily Megapodinae is restricted to the Neotropical Region. Large island chains tend to contain abundant asilid faunas, particularly those in southern Asia (WOOD 1981), whereas considerably fewer species occur on smaller island groups, such as the Hawaiian chain (LONDT 2006).

As their common name implies, robber flies have voracious appetites and feed on a vast array of other arthropods, a habit that may help maintain a healthy balance among insect populations in various habitats (JOERN & RUDD 1982; SHUROVNEKOV 1962). Adults of Asilidae attack wasps, bees, dragonflies, grasshoppers, other flies, and some spiders. Robber flies are particularly abundant in arid, sandy and sunny habitats, which supply optimal conditions for the observation of their many forms and behaviors.

Female asilids deposit eggs on leaves or stems of low-lying plants and grasses, in crevices within soil, under bark, or in burrows of wood-boring insects. Egg-laying habits depend on the species and its specific habitat; most species lay their eggs in groups while a few species deposit their eggs in masses, which are then covered with a chalky protective coating. However, females of the Leptogastrinae drop their eggs singly in flight (DENNIS & LAVIGNE 1976b). Many robber fly larvae live in the soil; others inhabit wood or other various decaying organic materials that occur in their environment; they are predacious, feeding on eggs, larvae, or other soft-bodied insects. Robber flies overwinter as larvae and pupate in the larval site. Pupae burrow upwards and emerge as adults, leaving behind their pupal casing. Complete development ranges from one to three years, depending on the species and environmental conditions (CANNINGS 1998). THEODOR (1980) proposed that larval growth is accelerated in warmer regions and that many asilid species live no longer than one year.

Robber flies seize their prey in flight and inject their victims with saliva containing a neurotoxin and proteolytic enzymes. This injection, inflicted by their modified mouthparts (hypotharynx), rapidly immobilizes prey and digests bodily contents (MUSSO 1978). The robber fly soon has access to a liquid meal, which is generally consumed upon returning to a perch.

The nature of the prey taken by adult robber flies appears to depend on many factors, but the most important may be the composition of the local insect fauna. LEHR (1959, 1964) has shown that changes in the seasonal feeding habits of robber flies often correspond to changes in the composition of the insect fauna. Additionally, according to ADAMOVIC (1963), the abundance of prey varies from year to year, and this may result in variation in the robber fly diet.

Estimates of the number of prey consumed daily by asilids have been given by DENNIS & LAVIGNE (1975, 1976a), LAVIGNE & DENNIS (1975) and LEHR (1964). These estimates have been derived from data that deals with the major period of foraging activity, average feeding and inter-feeding times, and the number of robber flies feeding in a given area. Thus, LEHR (1972) hypothesized that asilids in Russia consume between 9 and 18 prey per day.

Robber flies generally establish a perching zone in which to locate potential prey. This zone serves to separate various predator species in a single habitat as well as partitioning available resources (LEHR 1979; LONDT 1994).

Materials and Methods

Asilids were collected mainly by sweeping vegetation with a net (17" diameter) and utilizing light traps (2002-2006). Specimens were killed in cyanide jars, pinned, and wings were spread. Labels were printed which contained information on locality, plants on which the asilids were perched and date of collection). The second and fifth authors identified or confirmed the identification of the robber flies. In addition to field collections from rice fields and surrounding vegetation, materials in the collections of Tehran (Science & Research Branch), Shahr-e-Rey, Ghaemshahr and Amol Islamic Azad Universities, and Iran Rice Research Institute (Amol) were examined. The majority of specimens are deposited in the collection of 3rd author with additional material placed in the collection of 3rd author. The nomenclature and distributional data in the following records are based on data in CANNINGS (1998) and GELLER-GRIMM (2005).

Species list

Twenty six species in 19 genera and 7 subfamilies were collected from rice fields and surrounding grasslands in various localities throughout Iran. Of these, nine species are new records for Iranian fauna. The list of identified species, date of collection, sex of the predator and habitat or the plants on which they were collected, is given below:

Subfamily A p o c l e i n a e PAPAVERO 1973

Apoclea micracantha LOEW 1856

Synonymy: *Apoclea arabica* BECKER 1910: 136 sensu EFFLATOUN 1937 (questionable sensu GELLER-GRIMM 2002: 488).

M a t e r i a l : Isfahan province: Zarrin shahr (*Polygonum convolvulus*, Polygonaceae), 2♀♀; April 2002. Mazandaran province: Amol (Rice field), 1♂; September 2005.

D i s t r i b u t i o n : Egypt, Tunisia, Libya, Israel, Yemen and Morocco.

Philodicus ponticus (BIGOT 1880)

Synonymy: *Alcimus bimaculatus* BECKER in BECKER & STEIN 1913.

M a t e r i a l : Mazandaran province: Savadkooh (*Brachiaria eruciformis*, Gramineae), 1♂; July 2004. Khuzestan province: Dezful (*Sonchus oleraceus*, Compositeae), 1♀; October 2005.

D i s t r i b u t i o n : Greece, USSR-South European territory, Transcaucasus (incl. Azerbaijan), Soviet Middle Asia, Iraq, Israel, Turkey and Afghanistan.

Promachus canus (WIEDEMANN 1818)

Synonymy: *Asilus tesselatus* PALLAS in WIEDEMANN 1818 (nomen nudum).

M a t e r i a l : Mazandaran province: Behshahr (*Malva montana*, Malvaceae), 2♀♀; April 2005. Guilan province: Amlash (Rice field), 1♀; September 2005. Mazandaran province: Ghaemshahr (*Sorghum halepense*; Gramineae), 1♀; August 2006.

D i s t r i b u t i o n : USSR-South European territory, Kazakh (incl. Turkistan), Soviet Middle Asia, Afghanistan, Turkey and Taiwan.

***Promachus leoninus* LOEW 1848**

M a t e r i a l : Isfahan province: Isfahan (Rice field), 1♀; September 2002. Mazandaran province: Ghaemshahr (*Berberis integerrima*, Berberidaceae), 1♀; June 2006.

D i s t r i b u t i o n : Greece, Romania, Turkey, Yugoslavia (incl. Bosnia-Herzegovina, Croatia, Macedonia, Slovenia), USSR-South European territory, Transcaucasus (incl. Azerbaijan), Israel, Turkey, Myanmar (Burma) and India.

Subfamily A s i l i n a e LATREILLE 1802

***Aneomochtherus mundus* (LOEW 1849)**

Synonymy: *Asilus/Heligmoneura*: BECKER 1903/ *Neomochtherus*: ENGEL 1930/ *N. rhodius* TSACAS 1963.

M a t e r i a l : Mazandaran province: Sari (*Rapistrum rugrosum*, Brassicaceae), 1♀; August 2004. Golestan province: Kordkoy (Rice field), 1♂; July 2005. Mazandaran province: Mahmood-Abd (*Chenopodium opulifolium*, Chenopodiaceae), 1♀; September 2005.

D i s t r i b u t i o n : Greece and Turkey.

***Aneomochtherus perplexus* (BECKER 1923)**

Synonymy: *Cerdistus/Neomochtherus*: ENGEL 1930/ *N. repentinus* RICHTER 1963: 455.

M a t e r i a l : Khuzestan province: Ahwaz (*Robinia viscose*, Papilionaceae), 1♂; October 2004. Mazandaran province: Joibar (*Ziziphus spina - Christi*, Rhamnaceae), 1♀; July 2005.

D i s t r i b u t i o n : USSR-South European territory, Transcaucasus (incl. Azerbaijan) and Turkey.

***Machimus annulipes* (BRULLÉ 1832)**

Synonymy: *Asilus basalis* LOEW 1849/ *A. cerdo* GERSTAECKER 1861.

M a t e r i a l : Guilan province: Astaneh (Rice field), 2♀♀; August 2004. Mazandaran province: Ghaemshahr (*Trifolium pratensis*, Leguminosae), 2♂♂; September 2005. Mazandaran province: Mahmood-Abad (Rice field), 1♀; April 2006.

D i s t r i b u t i o n : Albania, Bulgaria, Greece, Hungary, Poland, Romania, Yugoslavia (incl. Bosnia-Herzegovina, Croatia, Macedonia, Slovenia), USSR-South European territory, Transcaucasus (incl. Azerbaijan), Israel, Turkey and Switzerland.

***Machimus armipes* BECKER in BECKER & STEIN 1913**

M a t e r i a l : Mazandaran province: Savadkooh (*Xanthium pensylvanicum*, Compositeae), 1♀; June 2006. Golestan province: Gorgan (*Rubus hyrcanus*, Rosaceae), 1♀; September 2006.

D i s t r i b u t i o n : Soviet Middle Asia.

***Machimus rusticus* (MEIGEN 1820)**

Synonymy: *Asilus genualis* ZELLER 1840/*A. obscurus* MEIGEN 1820.

M a t e r i a l : Mazandaran province: Sari (Rice field), 1♀; April 2004. Isfahan province: Khomeyni Shahr (*Polygonum convolvulus*, Polygonaceae), 2♀♀; September 2005.

D i s t r i b u t i o n : Austria, Albania, Bulgaria, Czech Republic and Slovakia, Ger-

many, Spain, France, United Kingdom, Italy, The Netherlands, Poland, Romania, Yugoslavia (incl. Bosnia-Herzegovina, Croatia, Macedonia, Slovenia), USSR-Central and South European territories, Kazakh (incl. Turkistan), Soviet Middle Asia, Switzerland, Greece, Turkey and Belgium.

***Machimus thoracius* (LOEW 1849)**

M a t e r i a l : Khuzestan province: Ahwaz (*Hibiscus syriacus*, Malvaceae), 1♀; August 2005. Mazandaran province: Amol (Rice field), 2♂♂; July 2006.

D i s t r i b u t i o n : Hungary, Turkey.

***Philonicus albiceps* (MEIGEN 1820)**

Synonymy: *Asilus albibarbus* ZELL., 1840 (error)/ *A. canescens* WD., 1820/ *A. nudus* LOEW 1840/ *A. domesticus* RIC. 1920/ *Cerdistus pulcher* BECK. 1923/ *C. marinus* BECK. 1923/ *C. orientalis* ES. 1969 (preo. RIC. 1922)/ *A. delector* (HARRIS, [1776]) ?: CHANDLER 1998/ *A. albiceps elutus* LOEW 1871: TOMAS 1998.

M a t e r i a l : Mazandaran province: Fereydonkenar (*Amaranthus retroflexus*; Amaranthacea), 1♀; September 2005.

D i s t r i b u t i o n : Austria, Albania, Belgium, Bulgaria, Switzerland, Czech Republic and Slovakia, Cyprus, Germany, Denmark, Spain, France, Coarse, Liechtenstein, United Kingdom, Greece, Hungary, Italy, Ireland, Iceland, Luxembourg, Malta, Norway, The Netherlands, Portugal, Poland, Romania, Sweden, Finland, Turkey, Yugoslavia (incl. Bosnia-Herzegovina, Croatia, Macedonia, Slovenia), USSR-North, Central and South European territories, Transcaucasus (incl. Azerbaijan), West, East Siberia, Far East, Mongolia and Israel.

***Polysarca ungulata* (WIEDEMANN 1818)**

Synonymy: *Laphria*/*A. ungulata* PALLAS: collection name.

M a t e r i a l : Guilan province: Rasht (Rice field), 1♀; 14 August 2005. New record for the Iranian fauna.

D i s t r i b u t i o n : Central and South European territory, Russia, Kazakh, Soviet Middle Asia, Turkey.

***Satanas gigas* (EVERSMANN 1855)**

M a t e r i a l : Mazandaran province: Sari (Rice field), 1♀; April 2006.

D i s t r i b u t i o n : Greece, Romania, USSR-Central and South European territories, Transcaucasus (incl. Azerbaijan), Kazakh (incl. Turkistan), Israel, Mongolia, China, Turkey, Algeria, Libya and Egypt.

***Trichomachimus oldroydi* MOUCHA & HRADSKY 1964**

M a t e r i a l : Guilan province: Fooman (Rice field), 1♂, 1♀; 5. April 2006. New record for the Iranian fauna.

D i s t r i b u t i o n : Afghanistan.

***Trichomachimus klapperichi* MOUCHA & HRADSKY 1964**

M a t e r i a l : Golestan province: Kordkoy (*Corchorus olitorius*, Tilliaceae), 1♀; 10 August 2006. New record for the Iranian fauna.

D i s t r i b u t i o n : Afghanistan.

Subfamily D a s y p o g o n i n a e MACQUART 1838

Tribe Dasypogonini MACQUART 1838

***Dasypogon octonotatus* LOEW 1869**

Synonymy: As ssp. of *D. diadema*/ *Dasypogon variabilis* BRULLÉ 1832 (ENGEL 1930; WEINBERG 1991).

M a t e r i a l : Mazandaran province: Ghaemshahr (Rice field), 1♀; April 2005. Khuzestan province: Andimeshk (*Ricinus communis*, Euphorbiaceae), 2♂♂; September 2005.

D i s t r i b u t i o n : Greece, Turkey, Romania, USSR-Central and South European territories, Transcaucasus (incl. Azerbaijan), Kazakh (incl. Turkistan), Soviet Middle Asia, West Siberia and Mongolia.

***Saropogon longicornis* (MACQUART 1838)**

M a t e r i a l : Mazandaran province: Joibar (Rice field), 1♀; August 2004. Golestan province: Gorgan (*Poa trivialis*, Poaceae), 1♂; July 2005.

D i s t r i b u t i o n : Egypt and Israel.

Subfamily L a p h r i i n a e MACQUART 1838

Tribe Laphriini MACQUART 1838

***Choerades gilva* (LINNAEUS 1758)**

Synonymy: *Asilus*/ *A. rufa* DE GEER 1776: 241/ *Laphria*?/ *L. bilineata* WALKER 1849: 1156.

M a t e r i a l : Guilan province: Somae-Sara (Rice field), 1♂; August 2002. Mazandaran province: Savadkooh (*Amaranthus blitoides*, Amaranthaceae), 1♀; June 2006.

D i s t r i b u t i o n : Bulgaria, Switzerland, Czech Republic, Germany, Denmark, France, Hungary, Italy, England, Norway, The Netherlands, Poland, Romania, Sweden, Finland, USSR, Mongolia, Nearc:/ USA/ California/ Colarado/ Arizoran/ Pennsylvania/ Washington/ Oregon/ Idaho/ Montana /North Dakota/ South Dakota/ Nebraska/ Minnesota/ Iowa/ Wisconsin/ Michigan/ New York/ Vermont/ Mein/ Canada/ Yukon/ Alberta/ North West Territoriy/ British Columbia/ New brunswick/ Nova Scotia/ Quebec/ Ontario.

Subfamily L a p h y s t i i n a e

Acrochordomerus aeneus HERMANN 1920

M a t e r i a l : Guilan province: Fooman (Rice field), 1♀; 4. October 2005. Khuzestan province: Dezful (*Tribulus terrestris*, Zygophyllaceae), 1♂; 28 August 2006. New record for the Iranian fauna.

D i s t r i b u t i o n : Syria, Turkey.

Subfamily S t e n o p o g o n i n a e HULL 1962

Tribe Dioctriini ENDERLEIN 1936

Dioctria flavipennis MEIGENI 1820

Synonymy: *D. aurifrons* MEIGEN 1820.

M a t e r i a l : Mazandaran province: Sari (Rice field), 1♀; August 2005. Isfahan province: Shahinshahr (*Xanthium pensylvanicum*, Compositeae), 2♀♀; June 2006.

D i s t r i b u t i o n : Austria, Bulgaria, Czech Republic, Germany, France, Hungary, Poland, Romania, USSR, Switzerland, Turkey.

Tribe Stenopogonini HARDY 1930

Anarolius fronto LOEW 1873

M a t e r i a l : Golestan province: Kordkoy (Rice field), 1♀; July 2006. New record for the Iranian fauna.

D i s t r i b u t i o n : Russia, Kazakh, Soviet Middle Asia, Turkey.

Anisopogon asiaticus OLDROYD 1963

M a t e r i a l : Mazandaran province: Ramsar (Rice field), 1♀; 24 September 2005. Golestan province: Gorgan (*Urtica dioica*, Urticaceae), 1♂; 10 June 2006. New record for the Iranian fauna.

D i s t r i b u t i o n : Afghanistan.

Cyrtopogon centralis LOEW 1871

M a t e r i a l : Isfahan province: Isfahan (*Adiantum capillus/veneris*, Adiantaceae), 1♂; 2. April 2002. Guilan province: Lahijan (Rice field), 1/; 3 June 2006. New record for the Iranian fauna.

D i s t r i b u t i o n : Russia (West and East Siberia, Far East), Mongolia, China, South and North Korea, Turkey.

Stenopogon junceus (WIEDEMANN in MEIGEN 1820)

Synonymy: *Dasypogon tanygastrus* LOEW 1861.

M a t e r i a l : Babol (Rice field), 1♂; September 2005.

D i s t r i b u t i o n : Spain, France, Greece, Turkey, USSR-South European territory, Transcaucasus (incl. Azerbaijan), Israel, Turkey, Afghanistan and Morocco.

***Stenopogon roederii* BEZZI 1895**

M a t e r i a l : Mazandaran province: Behshahr (Rice field), 1♀; 3 July 2006. New record for the Iranian fauna.

D i s t r i b u t i o n : Italy, Russia, Soviet Middle Asia, Transcaucasus (incl. Azerbaijan), Turkey.

Subfamily S t i c h o p o g o n i n a e HARDY 1930

***Stichopogon scaliger conjungens* BEZZI 1910**

M a t e r i a l : Guilan province: Rasht (Rice field), 1♀; 7 April 2005. New record for the Iranian fauna.

D i s t r i b u t i o n : Greece, Italy, Russia, Kazakh, Soviet Middle Asia, Turkey.

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Zusammenfassung

Raubfliegen (Insecta: Diptera: Asilidae) wurden in iranischen Reisfeldern und umgebendem Grünland im Zeitraum 2002 bis 2006 studiert. 26 Arten aus 19 Gattungen und 7 Unterfamilien wurden auf Reispflanzen festgestellt, 23 Arten auf begleitenden Unkräutern benachbarter Felder. 9 Arten ergaben sich als neu für die iranische Fauna.

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